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# **Executive Summary: Ecological Issues in Floodplains and Riparian Corridors**

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As part of the process outlined in Washington's *Statewide Strategy to Recover Salmon: Extinction is Not an Option* the Washington Departments of Fish and Wildlife, Ecology, and Transportation were charged to develop Aquatic Habitat Guidelines employing an integrated approach to marine, freshwater, and riparian habitat protection and restoration. Guidelines will be issued, as funding allows, in a series of manuals addressing many aspects of aquatic and riparian habitat protection and restoration.

This document is one of a series of white papers developed to provide a scientific and technical basis for developing Aquatic Habitat Guidelines. The white papers address the current understanding of impacts of development and land management activities on aquatic habitat, and potential mitigation for these impacts.

The scope of work for each white paper requested a “comprehensive but not exhaustive” review of the peer-reviewed scientific literature, symposia literature, and technical (gray) literature, with an emphasis on the peer-reviewed literature. The reader of this report can therefore expect a broad review of the literature which is current through late 2000. Several of the white papers also contain similar elements including the following sections: overview of the guidelines project, overview of the subject white paper, assessment of the state of knowledge, summary of existing guidance, recommendations for future guidance documents, glossary of technical terms, and bibliography.

This white paper examines and synthesizes the literature pertaining to the current state of knowledge on the physical and biological effects of alluvial river channelization, channel confinement, and various channel and floodplain modifications. It also examines and summarizes literature on the mitigation, rehabilitation and restoration of rivers affected by these human modifications. Data gaps in our current understanding of physical and biological process, the effects of human modifications, and appropriate rehabilitation or restoration techniques are also reviewed.

Databases accessible through the University of Washington library were used as primary information sources. Additional information sources included other library systems, the Internet, and governmental gray literature. The reference section in this document cites all papers used for writing. However, the literature review and topic summary are not comprehensive, as there are many additional informational sources that were beyond this review in scope and detail, or that were not discovered. For the ambitious reader, there is an additional database that includes all references that were found, including those not cited in the text.

The paper begins with an overview of ecological and habitat issues associated with streams and riparian zones in Washington State and the Pacific Northwest. A basic review of the science behind river hydraulics, river morphology and habitat formation is given, as is a review of riparian ecology and its importance in maintaining and forming aquatic habitat. Definitions of stream corridors and channel migration zones given by various authors are reviewed.

The results of the literature review are documented in a synthesis of the ecological and habitat effects of channelization, channel confinement and construction. The vast amount of literature on these subjects prohibited an exhaustive review. The most pertinent information is included by individual topic and in summary tables. Past literature reviews, summary reports and detailed investigations are cited for further reference and detailed information. The physical and morphologic effects of channelization are first reviewed to highlight how habitat templates have been or potentially could be modified. Then, the responses of different groups of organisms (invertebrates, fish, plants, birds, mammals) that are dependent on functional riparian corridors are reviewed. Data gaps in our current knowledge in connecting cause and effects relationships in complex ecological systems are reviewed.

The field of hyporheic ecology has developed and grown over the last three decades. Thus, the functional importance of hyporheic and perirheic zones in alluvial streams is reviewed. However, the effects of human activities on the hyporheic and perirheic zones have only been recently investigated. Our current state of knowledge in regards to human modifications of these ecotones is synthesized from the direct literature on the effects of channel modifications on hyporheic/perirheic processes. Derivations are also made from associated literature on the general effects of channelization and general hyporheic processes in unmodified fluvial systems. Many scientific data gaps exist in the hyporheic/ perirheic literature.

The paper includes a section on habitat protection and mitigation techniques. Alternative management strategies such as passive (vs. active) restoration, streamside vegetation retention or promotion, and modified in-channel vegetation removal are reviewed. Recommendations by various authors on how to minimize impacts during design and construction are also summarized. Preservation of channel morphology, incorporation of vegetation into embankments, and alternative bank protection techniques are major features of this section.

In recent years there has been a societal push to rehabilitate and/or restore streams and rivers degraded by channel modifications. The development of restoration paradigms and strategies has been based on our understanding of natural systems. However, relatively little information has been published on working policies, pilot studies or experiments, restoration designs, implementation methods, and effectiveness monitoring of restoration activities. Furthermore, most projects have been implemented for the mitigation and enhancement of small site-specific sites. The paper ends with a review of large-scale rehabilitation and restoration projects and techniques in the literature.